Probabilistic Volcanic Hazard and Risk Assessment

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The term *hazard* can lead to some misunderstanding. In English, *hazard* has the generic meaning “potential source of danger”, but for more than thirty years (e.g., Fournier d’Albe, 1979), *hazard* has been also used in a more quantitative way, that reads: “the probability of a certain hazardous event in a specific time-space window”. However, many volcanologists still use “*hazard*” and “*volcanic hazard”* in purely descriptive and subjective ways. A recent meeting held in November 2006 at Erice (Italy) entitled “*Quantifying long- and short-term volcanic hazard: building up a common strategy for Italian volcanoes*” (http://www.bo.ingv.it/erice2006) concluded that a more suitable term for the estimation of quantitative hazard is “Probabilistic Volcanic Hazard Assessment” (PVHA, hereinafter).

A more detailed report on this meeting can be found in the electronic supplement of the journal. Here, we emphasize the most impellent need emerged by the workshop, that is the need to assess the volcanic hazard with a probabilistic approach accounting simultaneously for different kinds of information (models, data, etc.)

The extreme complexity, nonlinearities, limited knowledge, and the large number of degrees of freedom of a volcanic system make deterministic prediction of the evolution of volcanic processes difficult. In other words, volcanic systems are stochastic and hazardous volcanic phenomena involve so many uncertainties that a probabilistic approach is often needed. In general, probabilistic and stochastic modeling have a two-fold application: to set up evidence-based models, and to build a framework that merges all kinds of available information (theoretical, empirical, geological, volcanological, geophysical, historical, etc…). A reliable PVHA, in turn, becomes the rational basis for critical decision-making for safety and mitigation. A major outcome of the Erice workshop was essentially full advocacy of the use of the PVHA approach as a tool in mitigating volcanic risk to communities, in the long-term, prior to onset of volcanic unrest and in the short-term, during volcanic activity and during “volcano crises”.

The probabilistic approach does not in any way reduce the importance of deterministic studies and the analysis of specific scenarios. The simultaneous use of physical models and data contrasts with what is sometimes encountered in seismic risk analysis, where deterministic and probabilistic approaches are often considered irreconcilable (e.g., Castanos and Lomnitz, 2002). In seismic hazard assessment, the terms “probabilistic” and “deterministic”, contained in acronyms PSHA and DSHA, reflect the kind of strategy adopted, mostly evidence-based for PSHA and mostly based on physical models for DSHA. In volcanology, we do not see this conflict; we attempt to use all the information we have (models, data, and expert beliefs), and the term “probabilistic” in PVHA only emphasizes that the quantification of volcanic hazard takes account of associated uncertainties.

REFERENCES

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